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A Semantic Multi-Agent system to Exchange Information between Hospitals

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Abstract

The amount of information in hospitals and the medical field is consistently increasing. Traditional information retrieval systems in hospitals are lacking, and the medical industry has been slow to adopt technology because it requires accurate and effective information. In order to achieve a solution, Statistics and Collaborative Knowledge Exchange (SCKE) is a multi-agent system that allows the retrieval and exchange of information between hospitals. The proposed system uses semantic search techniques to provide results that are more accurate. We examined the system accuracy, and the experiment results show a high accuracy rate, regardless of the number of queries.

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Keywords: semantic; multi-agent; ontology; information retrieval; Medical Data Mining;

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1. Introduction

In the medical field, the growth of information has become an unavoidable challenge, and this information requires the support of an accurate retrieval system. Traditional information retrieval systems are lacking due to their poor support of semantic comprehension. The challenge is to provide a collaborative information exchange between hospitals and clinic systems to make it easier for medical researchers and employees.

In order to face these challenges, this paper proposes a semantic retrieval system for disease information. Diseases are recorded and categorized in the information centre of the hospital. Using a semantic search (a data-searching procedure that focuses on the contextual meaning and the user's intent, instead of searching for only keywords), improves search accuracy and generates more relevant results.

The proposed system also supports multi-agent systems (MAS). A feature of MAS is the use of several components called agents, which have autonomous behaviour and a set of rules to ease interaction [1]. The agents share the same ontology, which allows the exchange of meaningful and understandable information for all parties involved [2,3].

Ontologies play an important role in achieving interoperability across organizations and on the Semantic Web. Ontology can provide a common vocabulary, grammar for publishing data, and can establish a semantic description of data. Ontology is considered the backbone of the Semantic Web [4].

The purpose of this paper is to discuss the system SCKE (Statistics and Collaborative Knowledge Exchange), which retrieves and exchanges disease information between hospitals using MAS and semantic search as a data-searching technique. The MAS implements an agent to the hospital's system, which gives it permission to act on behalf of the user, allowing the exchange of information between hospitals.

2. Related Work

This section briefly surveys the recent studies relevant to two aspects of SCKE research, semantic search, and ontology building. It also discusses MAS and its development.

AIOS is a multi-agent, ontology-based information-sharing system. AIOS supports file sharing among a community of users connected through the Internet (peer-to-peer sharing). Each time the user adds or removes information; the responsible agent updates the search indexes and the ontology. The AIOS system is implemented by the JADE development environment and a Nutch PlugIn to build AIOS ontology[5].

MET4 is a multi-agent decision support system that allows interdisciplinary healthcare teams to manage patients according to specific clinical workflows. MET4 is implemented using the Workflows and Agent Development Environment (WADE) and the ontology's domain models, and Protégé 6 implements its data repositories.

MASE is a semantic multi-agent for decision support in epidemiology issues. This system makes good use of spatio-temporal analysis (geospatial data) for specified epidemics. MASE builds its ontology using Protégé[27] software and implements the system agents using Java agents developed by JADE [7].

For semantic, ontology-based systems there is Kartika. Kartika is a search system for doctor schedules and hospital facilities that is based on the Semantic Web. Kartika works with two kinds of data: real and dummy data. It was developed using the PHP web language, Semantic Web techniques, and built with Protégé and a simple MySQL database. Kartika uses RDF (Resources Description Framework) to represent semantic information. It is a light system for use in a single hospital [8].

In one study [9], the authors present a semantic, ontology-based search engine for cancer. This semantic search engine covers all details about cancer—its categories, causes, and symptoms. The authors develop the system ontology using Protégé 2000 and use the RDF Gateway framework for developing the environment and servers. Table 1 summarizes the main characteristics of the related systems.

When compared to previous works, SCKE is a light and easy-to-use system that focuses on patients and diseases; it